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ABSTRACT

This project was initiated in response to the science and mathematics language needs of Sea Island students who speak African-American dialects. Research has indicated that there appears to be a relationship between dialect diversity and academic success. In response, the program's goals were to identify students who exhibited dialect/language diversity; to document the characteristics of that diversity; and to implement teaching/learning strategies to enhance a student's ability to process information and communicate about it in a Western modern way. As a case study, it involved the constant comparison of language tapes and field notes, participant observation, and review of documents. Each of the sessions also included the implementation of instructional strategies designed to help students enhance their content learning and the ability to communicate about it. Documentation shows that the specific science and mathematics techniques helped students to recognize the need to use precision via explicit and highly descriptive words when communicating with non-island speakers. In general, outcomes indicate that the issues of dialect diversity and its impact on the communication of intuitive knowledge need to be recognized and acknowledged by both dialect and non-dialect speakers. (Contains 82 references and a figure.) (Author/RS)

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A Civil Rights Issue?
Vocabulary Development in Math and Science

by

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A Civil Rights Issue?
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Abstract

This project was initiated in response to the science and mathematics language needs of Sea Island students who speak African-American dialects. Research has indicated that there appears to be a relationship between dialect diversity and academic success. In response, the program's goals were to identify students who exhibited dialect/language diversity; to document the characteristics of that diversity; and to implement teaching/learning strategies to enhance a student's ability to process information and communicate about it in a western modern way.

As a case study it involved the constant comparison of language tapes and field notes, participant observation and review of documents. Each of the sessions also included the implementation of instructional strategies designed to help students enhance their content learning and the ability to communicate about it.

Documentation shows that the specific science and mathematics techniques helped students to recognize the need to use precision via explicit and highly descriptive words when communicating with non-island speakers. In general, outcomes indicate that the issues of dialect diversity and its impact on the communication of intuitive knowledge need to be recognized and acknowledged by both dialect and non-dialect speakers.

Language Development in Math and Science

Science educators have been studying students' science and mathematics misconceptions for many years. There have been multiple explanations for the way students in public schools perceive the natural world and the mathematical language used to describe it. One explanation that is often overlooked is the fact that language is a major factor in understanding both science and mathematics. Individuals whose language achievement differs from the norm often have difficulty in these subject areas. In our local area many students are language divergent from mainstream English. More than half of our public school students are either lower socioeconomic status (SES) and/or of African descent. These students typically score much lower on standardized tests and high school completion exams. After working with these Sea Islands students for several years, it came to our attention that their language patterns were likely a major cause of poor academic performance. This notion is mentioned in the Collin's (1988) article when he states, "The effect of linguistic and cultural diversity on the educational achievement of working-class and minority students remains a question of great interest and controversy" (p. 299).

The Early Controversy

Early research in reading comprehension has supported the belief that dialect usage has a negative impact on the visible demonstration of academic reading achievement (Goodman, 1965; Hunt, 1975). The state of language development in science education parallels the reading achievement situation. Often, the focus in reading research was on the interaction with and believed interference of dialect usage upon overall comprehension scores (Hutchinson, 1975). However, certain work in the area suggests that this situation may be more a function of teachers' not accepting a reader's particular dialect than an actual lack of comprehension (Goodman & Buck, 1973, 1997). Dandy (1988) cited a variety of negative responses, including giving less praise for correct answers that teachers have been shown to display toward dialect speakers. It is also distinctly possible that attitudes on the part of both children and teachers regarding dialect may have a greater impact on fostering academic (reading) failure than the mismatch of a child's home dialect (language) with the school language (Seitz, 1977). For example if, "Rocky Balboa says *Ain't it nice, you an' me heah tugeddah?*, then it's English, but that if a black person says *Ain't it nice, you an' me heah tugethah?* it's African" (McWhorter, 2000, p. 53). However, whatever the explanation/rationale, it would appear that dialect usage has not boded well for a student's reading comprehension and academic achievement. This same thing happens in science where teachers' inexperience with African American dialect results in an inability to recognize the science knowledge that the child is trying to communicate. Such attitudes and behaviors have had a negative impact on children's academic progress.

Negative views of Island language, known as Gullah, stem from the earliest studies whose findings reflected the notion that the island folk were speaking a simplified form of English used from master to slave. These studies were authored by Gonzales (1922), Johnson (1930) and Mencken (1948) and specifically took a very condescending approach to Gullah as lazy, careless, clumsy tongued speech. These studies are still cited by those who do not recognize or are not willing to recognize the Gullah language and subsequent decreolized dialects. The first study to oppose this idea that Gullah was and is simply the "worst English" began with Turner in (1932). That insight has continued since with other others (e.g. Cassidy, 1983; Jones-Jackson, 1987; Baird & Twining, 1991) and is documented in the film Family Across the Sea (1991). The evidence to date is highly supportive of Gullah as a creolized language. It is not bad English but another way of speaking/communicating that has its base in several African and some European (English and French in particular) languages.

Math and Science

Reading as an important language benchmark of academic performance has powerful links to math and science. All these areas provide compelling statements regarding each student's academic success. As can be seen, the national trend of science and math achievement for African-American high school students is lower than their white counterparts (NSF, 1996). Studies have

shown that only one out of five black students enrolls in physics courses in American high schools (NSF, 1996). This situation illustrates the fact that low-income and/or African-American students enrolled in secondary schools where they are the majority have less extensive and less demanding science and math programs available to them (Oakes, 1990). In addition, this group of minority students tends to be unable to pass the secondary gate keeping courses of algebra and physical science and then to drop out of the academic program of science and math course-taking (Willis, 1995). Because of this state of affairs, low income and/or African-American students have little access to lucrative science and math careers.

Explanations for the lackluster status of African-American, lower SES and other minority students in science and math range from their lack of access to courses and high quality programs (Oakes, 1990), to low teacher expectations of certain minority students and the fulfillment of that prophecy (McCormick & Noriega, 1986), to the more current belief that because education occurs in a social context, each individual's learning is mediated by culture and prior, indigenous knowledge (Linn & Burbules, 1993; Aikenhead & Jegede, 1999). Culture in which language plays a major role is a common way of life which includes knowing, valuing, expressing emotions, and interacting with others (Geertz, 1973). When there is a clash between a pupil's home culture and the academic culture, problems may arise, especially in the highly specialized community of science (O'Loughlin, 1992; Snively & Corsiglia, 1998).

For African-American children who come from a rich oral tradition of "verbal art" (van Keulen, Weddington, & DeBose, 1998, p.35) the encounter with the highly linear, objective, and rational culture of science (Jegede, & Aikenhead, 1998) may create an experience of academic violence brought on by a mismatch between the cultures/languages (O'Loughlin, 1992; Aikenhead & Jegede, 1999). Teachers need to be aware of the multiple cultures and languages that are operating in their classroom. However, cognition is not enough; teachers need to be willing to explore possible ways to be involved in their students' culture and language.

The Connections

Teachers definitely do need to foster linkages or crossovers between a student's home language and culture and that of the classroom (Jegede & Aikenhead, 1998; Aikenhead & Jegede, 1999). They need to know how to help students go from the known (home) to the unknown (classroom) for more harmonious, successful learning. A first step is their ability to take advantage of the very real, tangible linkages between particular academic areas. For example, both science and math activities and literacy activities, such as reading and writing, focus on thinking processes and promote the same intellectual skills (Mechling & Oliver, 1983; Wellman, 1978). When a teacher is helping students learn how to describe what happens in hands-on science, the students are actually learning the processes of isolating salient characteristics, enumerating those characteristics, and using the appropriate terminology and possible synonyms--all recognized reading skills (Wellman, 1978). Because science process skills are essential not only to logical thinking but also to language learning (Barufaldi & Swift, 1977) it has become evident that **utilizing appropriate early experiences in science** can help children of all socioeconomic levels in overall language and logic development (Bethel, 1974). For example, first graders who experienced the Science Curriculum Improvement Study (SCIS) unit on material objects demonstrated improved scores on the Metropolitan Reading Readiness Test (MRT) (Kellog, 1971; Renner, Stafford, Coffia, Kellogg, & Weber, 1973). Thus there is evidence that utilizing specific, appropriate science activities provides a crossover to increased literacy achievement.

In educating African-American children, some areas that deserve particular attention with regard to crossovers and linkages are recognizing the existence of language codes (Bernstein, 1961) and facilitating the process of code switching (van Keulen, Weddington, & DeBose, 1998). Bernstein (1961) cites the existence of codes as a form of communication which reinforces social relations within a group by highlighting shared identifications and experiences and eliminating the need for elaborate explanations. In addition, van Keulen, Weddington, & DeBose (1998) have focused on the duality of African-American code systems. Although many African-Americans tend to socialize among themselves and use only African-American English (AAE), those in professional fields have learned more standardized, traditional forms of English but are able to

revert to AAE if they so choose (Mufwene, 1997). Therefore, helping African-American children acquire facility in code-switching from their home language and culture to that of the school should be a priority in education. Aikenhead and Jegede (1999) talk about the same kind of issue when referring to cultural border crossing. Such action involves helping the students learn how to adapt language usage to context and situation and doing so with "...respect for the integrity of the children's home life and culture..." (van Keulen, Weddington, & DeBose, 1998, p. 199). Enabling children to successfully make the crossing from home culture to school culture and language would appear to make crossing the cultural border (Giroux, 1992) to the even more sophisticated realm of science easier.

The question remains as to why such crossovers, linkages, and transitions have not been more prevalent. It is not an accident that African-American children are well-represented in special education and have high underachievement and dropout rates (Rossi, 1994; van Keulen, Brown, Webster, & Elzey, 1997). According to McWhorter (2000) , "It was actually proposed in the 1960's that sentences *like this* (italics added, e.g. She my sister. I BEEN married) were an indication of genuine cognitive deficiency among black American children" (p.27). Sentences *like this* were considered broken sentences and an indicator of cognitive deficiency. The problem with this thinking is that such writing permeates the Christian Bible and many other languages around the world (McWhorter, 2000). Sentences around the world often include either the same meaning for the verb be or the lack of a being verb to indicate relationship such as in the *She my sister* sentence.

Teachers also need to understand the tonality used by students that indicate meaning. For example, if an African-American dialect speaker emphasizes a different word in a phrase the entire meaning might change. If the child says I DON'T know, then the child has no clue and is not very interested in working on the problem. However, if the child says I don't KNOW, then he or she expects and wants clues or more questions to help them figure out the answer. It can be misunderstood further if the child substitutes **UH** for **don't** (I uh Know). According to McWhorter (2000), "White teachers, however, have sometimes missed the meaning of the intonation difference between standard and Black English and assumed that the black students were being uncooperative" (p. 35).

The non-verbal aspect of communicating needs to be viewed through the cultural lens of the community as well. Local island children are known for standing with their left hand on their hip with their right hand out in front of them. This is typically viewed as the child "telling the adult" that they are stubborn and not interested in hearing. In reality, this posture means the opposite according to Pollitzer (1999) "the left hand on the hip presses down evil; the right hand "vibrates" the future in a positive manner." Another variation places the right hand over the heart. Pollitzer was talking about escaping a negative situation or supporting warriors from the African traditions, but this signaling is used by local students.

This signaling is usually seen in a situation where an adult and a child are in conflict about the meaning of an interaction or behavior.

> Generally, the teacher has misinterpreted the student's intent and is "pushing the student into the corner" verbally. The student uses this signal to mean that I am in control of myself, I know what I did, what I mean, etc. In effect, the child is telling the teacher to "back off" because he or she is wrong. This signal can be a prelude to physical behaviors from the student that are not desirable in a school setting. These behaviors could be overcome if the teacher stopped and asked the child for an interpretation of what was happening with an open mind to hear and understand the students meaning. These practices have been used for so long that it is unlikely that the students could verbalize any ancestral meaning for the physical action of hand pressing or vibrating (Margaret Ficklen, personal correspondence April 25, 2000).

Another non-verbal gesture that often gets interpreted as aggression is what the locals call the "hello shoulder bump." Students are often seen throwing a shoulder at each with a big smile on

their face. The teachers often send them for disciplinary action. The students were only acknowledging each other, or saying hello. These non-verbal miscues are instances that often lead to the students feeling unjustly punished and when they return to the classroom they are likely to become truly disruptive (Ficklen).

Teachers have been identified as major contributors to this status quo (Darder, 1991; Rossi, 1994). It may be that teachers have lowered expectations of these students which affects performance. However, in some instances teachers of African-American children know they understand concepts but fail to demonstrate their knowledge on achievement tests--a fact outlined by vanKeulen, Weddington, & DeBose (1997) in explaining the difficulties in testing African-American children. It may also be that constructivist instruction which allows students to work from the whole to the part, to construct their own understandings and to experience language embedded in social contexts is the best match for the cultural style of these children (Au, 1993). Working with areas such as science and math, we need to give children opportunities to combine language explanations with what they are doing (Jones, 1990).

Sociopolitical Context

According to Durgunoglu and Verhoeven (1998),

> It is clear that literacy development in multilingual contexts is affected by quite a few interrelated factors. This complexity requires a wider perspective and necessitates the inclusion of political, social, and cultural contexts while studying the psychological or educational issues (p. 289).

In other words, when studying an educational issue, the larger context of what happens when different language codes come in contact with each other also informs the teaching and schooling practices. In this area, the larger context involves economics or who is suited to which kind of job and who should be working for whom and under which conditions.

Languages around the world have characteristics more and less like English. For example Swedish has many language roots in common with English, but Finnish does not. Swedish speakers did significantly better on national tests than Finnish speakers even though all students were taught in the same school (Durgunoglu and Verhoeven 1998, p. 294). Durgunoglu and Verhoeven cite that learning a second language such as Urdu and Hindko does not hamper literacy development even though the conditions were not optimal for learning but because the two languages have a similar base (p. 294). West African languages that form the creolized language Gullah are similar to the Finnish example in that both have few common roots to English. For the most part English words were simply used to replace West African words (Glascoe, 1998). Thus even though our students are speaking and using English words their understanding is built on the syntax of West African languages. This implies that meaning is made in a more implicit manner, with time frame references that equate to **is vs. is not** in English, whole picture messages rather than the adding of thick description in sequence of the component parts (Aina, 1998). This is also supported by Pollitzer (1999) when he speaks about the way an African-American preacher creates a whole and very complex picture within his or her sermon. Like the Swedish/Finnish finding, this data suggests that our students would, because of language background, score more poorly on standardized tests.

Other sociopolitical issues relate directly for the purposes of schooling and who is/was legally able to be schooled during different historical periods in the U.S. It has been documented that, "Segregation in public schools in the United States is directly related to maintaining an inexpensive source of labor" (Spring, 1997, p.54). While the U.S. is not the only example of using economics as its basis for the way it educates its children, it is the one we are focusing on in this paper, particularly in South Carolina. In fact, the tradition in South Carolina began with the advent of humans being sold as technology and laws being written to prevent them from being able to read and write (Bullock, 1970). Thus the African-American population in South Carolina was clearly dominated by laws that forbade their being educated. Domination of one group by another often leads to subversive actions by the oppressed (Friere, 1970). Thinking of living under such

laws and life conditions as slavery, one can understand the distrust and dislike for whites that the African-Americans felt. It also created the opportunity for a language that would develop subtleties that one group would understand and use against the other.

Relationships between masters and slaves caused this group to create an ethics system that is based on trickery so that in the end the slave could triumph over the master (Spring, 1997). Spring explains:

> Within the ethical system of slavery, a slave did not consider taking something that was forbidden from the master as stealing. For instance, inadequate food was a constant problem for slaves. The reasoning of the slave was that taking food from the master was not stealing since the master owned the slave and the food consumed by the slave remained in the ownership of the master (p. 54).

Stories that illustrate the ethics and trickery are often named after the story teller or are called Brer Rabbit tales. An example of such is a,

> story of Henry Johnson who lured a turkey into his cabin and killed it. He immediately ran crying to his mistress that one of her turkeys unexpectedly died. She told him to stop crying and get rid of the possibly diseased bird. That night Henry ate turkey (p. 54).

Island students still think it is great fun to see who is the best trickster storyteller.

The notion of cultural superiority also deserves attention. Many of the original slave owners were English. At the time of their arrival the English felt themselves culturally superior to the pagan/heathen Native Americans and the Africans they imported as chattel (Spring, 1997). "The culture wars of the late twentieth century reflect the centuries-old effort to make English and Anglo-American Protestant culture the unifying language and culture of the United States", (Spring, 1997, p. 116). The language and culture of public schooling and testing are based on the English and Anglo-American Protestant ethic and are in cultural and language divergence with the majority of our students.

Project Description

Thus, through the literature there appears to be continuing dialogue and debate concerning language/dialect diversity and academic success, social and financial success particularly in areas with specialized vocabularies and highly rational knowledge systems such as science, mathematics and reading. In response, our project's goals were to identify potential students who exhibited dialect diversity; to document the significant characteristics of that diversity; and then to engage in teaching/learning strategies intended to accelerate the ability of students to process specific information, aid in code-switching and cultural crossovers, and help in the construction of knowledge.

This project on John's Island, one of the Sea Islands in South Carolina, had its origins as a case study involving both a language and a science education specialist from the College and University of Charleston, a resource specialist from Rural[1] High School, an English teacher with a

[1] All names of students and schools are pseudonyms

strong background in linguistics, and a resource student who exhibited characteristics of dialect and cultural diversity-our basic criteria. Later that year sessions were expanded to include two other students and another teacher. In the second year, three new students from the class of the resource specialist were added to the project. In the third year we worked with an entire class of resource students (9). The second criteria involved in selecting our students was a consistent inability to pass various sections of the South Carolina Exit Exam, passage of which is necessary for graduation from high school in South Carolina.

Students

All participants in the study exhibited dialect and cultural diversity, a factor consistent with the overall demographics of a school which houses a population that is 84% African-American, 13% Caucasian, and 3% Hispanic. In addition, the students at this school are on free or reduced lunch status and are thus considered lower socioeconomic status (SES). Currently, students on John's Island typically score 45-48% lower on tests in these areas than more affluent students in neighboring constituent districts (CCSD, 1996-1998), thus reflecting the national trend (NSF, 1996).

The students whom we will be discussing in this paper represent that pattern of 45% lower achievement, along with relegation to the Resource Room because of failure on a multitude of standardized tests including the South Carolina Exit Exam (SCEE). Continuing criteria involved in selecting these students were the consistent inability to pass various sections of the SCEE (reading, writing, math, science). Students must pass this exam to graduate from high school in South Carolina. The SCEE exam is based on content standards that have been approved by the South Carolina State Board of Education. This is a norm-referenced test in the above mentioned content areas that students must score above 600 to pass. The total score for each section is 800. Students who do not pass this essentially basic-skills exam receive a certificate of attendance rather than a high school diploma.

Each of the students was several years behind his or her peers in the academic course work that they were taking as well as being assigned to the least academically challenging courses in the school. In addition, one of the outstanding characteristics of the students was their predominant and consistent use of Island language (a decreolization of Gullah) which was represented not only in word usage and grammar but also in pronunciation and tonality. There was a mutual lack of regard reported between these students and most of their teachers, with the exceptions being a few teachers who believed that the students knew more and were capable of much more than their academic records indicated.

Teaching Tactics Used With the Students

Initially, with all the case studies, time was spent talking about the students interests and using various levels of inquiry. At least one of the following aspects of inquiry was an unknown in all teaching lessons:

what's the question
what's the procedure
what's the finding?

In addition, varying phases of inquiry were emphasized:

exploration
questioning
and testing variables (Rakow, 1986; Dyasi,1991; Coburn, 1997).

Concurrent with the student observations was the implementation of a variety of instructional strategies designed to help the students enhance both their language and content learning. The techniques involved were undertaken to accelerate rather than remediate the students and were accompanied by focused discussions, interaction conversations related to differentiating fact and inference, writing workshop, language experience activities, and dialogue journals. Reactions of the students to the strategies were documented on a regular basis.

Case Study Procedure

For this study we chose to work in a qualitative tradition that focuses on case studies. Qualitative case study (Bogdan & Biklen, 1998) was chosen because we needed students with extreme examples of non-traditional English to illustrate easily the patterns that emerged while the students were using their Island language to become literate in math and science. Choosing specific students so that patterns stand out is purposeful sampling (Bogdan & Biklen, 1998). We were able to use purposeful sampling in order to keep the research focus at the forefront (McMillan & Schumacher, 1997). The criteria for the purposeful sampling was dialect diversity, failure to pass the exit exam, retention in special education, and lowest level or no course work in math or science as well as limited exposure to English literature classes.

These students were specifically selected for the project because they demonstrated the greatest needs due to: dialect diversity, failure to pass the exit exam, retention in special education, lower SES status and lowest level or no course work in math or science during their high school career. Observations indicated that the students appeared to exhibit language characteristics similar to what is associated with traditional Black English, such as lack of a past tense or the deletion of "s" on third person singular verbs (Hale-Benson, 1986). However, the Sea Island culture also seemed to produce some unique dialect characteristics of its own. Conferences with the linguistics specialist at the high school confirmed that indeed there were specific island ways of communicating. His work and ongoing interactions with large numbers of students revealed differences in the usage of past tense, possession, and pronouns.

Another reason for choosing qualitative case study was because we wanted to look at specific cases in depth. Case study was utilized "precisely because the researcher wishes to understand the particular in depth, not to find out what is generally true of many" (Merriam, 1998, p.208). We specifically kept careful notes about our work with the students and recorded information on a case by case basis.

There were 12 students who were studied weekly. The observations were for a minimum of one and a half to a maximum of three hours per week between the months of October and May over a three year time frame. Of the reported cases one was studied in 1996-1997, three were studied in 1997-1998, and nine were studied in 1998-1999. All cases were studied at one high school of the Sea Islands. We collected data in the traditional three formats of field notes, taped interactions, and artifacts (Bogdan & Biklen, 1998). Our local schools are in particular need of teachers who can border cross and/or code switch and teach the students to do the same.

Finally, we chose case study for the purpose of motivating and facilitating science and mathematics teaching in this area. Case studies are often more motivating for learners, but specifically, "...they promote better problem solvers and critical thinkers" (Ertmer, Newby & MacDougal 1996, p. 720). It is our hope that our present and future teachers will use this research as a basis for self/critical reflection. Koballa and Tippins (2000) suggest such research can be used by teachers,

> to recognize how their own assumptions influence the ways in which they make sense of the dilemmas portrayed in each narrative. Additionally, we ask our readers to consider the deep social and political structures that surround each case (p. 7).

We feel that due to the extremely complex language, social and political structures involved with this study that qualitative case study best suited our needs.

Field Notes

Field notes were collected by one researcher each session. Each entry included a time line, attendance, descriptions of the dialogue and activities, and observers' comments. The field notes were written each week that the researchers were teaching in the classroom. The field notes were taken to assist in collecting details that would be missed through the use of audio tapes such as notes on blackboards, seating arrangements, people in the room and student actions.

Taped Interactions

Interactions between the person teaching the lesson and the students were taped. The tapes were transcribed for later data analysis. The taped interactions provided the researchers with verbatim language usage, inflection and tonality associated with the home dialect spoken by all of the students in the study.

Artifacts

Artifacts such as items constructed, drawings, language experience charts, journal writings, completed stories, and illustrations depicting the math and physics concepts that the students studied were collected.

Data Analysis

Triangulation of the three data sources, field notes, taped interactions, and artifacts occurred recursively throughout the study. Each of the researchers completed an analysis and then compared findings. Findings that were agreed upon are reported in this document (Bogdan & Biklen, 1998).

Outcomes

As participants in the project, all students appear to have benefited from the targeted strategies and made progress in passing the various portions of the SCEE. One has passed the reading, writing, and math portions of the test, graduated with a diploma, and is enrolled in a college program. All the seniors from the third year of data collection have passed all parts of the SCEE and received their high school diploma. Other participants continue to make progress and several have been released from the Special Education Program because of their progress. No doubt the success that they have experienced in becoming more precise and detailed in their writing as well as in communicating their science and math knowledge will serve them well in the future.

Discussion

As we listened to their stories, wrote with them, and engaged in inquiry activities, it became apparent that the way our students looked at the world is different from ours. It also became clear that we would have to do content specific language development to enable these students to communicate their knowledge to the outside world. Because our goal was definitely not to eradicate their native language and culture, we focused on code switching as a means of preserving their heritage while giving them two ways to communicate about the same topics. In addition, the alternative terminology that we used with the students was designed to stretch both their thinking and their precise use of words, a technique that is in line with Bruner's work (1983) concerning scaffolding and language development.

Western Modern World View vs. Indigenous Structures

There are certain factors in the western, modern world view that are inconsistent with the indigenous structures that we noted in the data from the case studies. These inconsistencies are time frame reference, part vs. whole and holistic inference vs. explicit description. Thoughts about indigenous science are well documented in biology and ecology (Snively & Corsiglia, 1998). Indigenous science is often called traditional ecological knowledge (TEK). For the purposes of this paper Snively and Corsiglia's definition of indigenous science will be used:

> Indigenous science relates to both the science knowledge of long-resident, usually oral culture peoples; as well as the science knowledge of peoples who as participants in culture are affected by the world view and relativist interests of their home communities (p. 1).

This TEK view has been challenged as non-scientific by such authors as Good (1995), Matthews (1994) and Wopert (1993). Our purpose is to use the students' indigenous knowledge as the starting point for code-switching their descriptions to a form that standardized test makers use.

Western modern science has been described as, "the officially sanctioned knowledge which can be though of as inquiry and investigation that western governments and courts are prepared to

support, acknowledge and utilize (Snively & Corsiglia, 1998, p. 4)".The western modern view of science generally holds that there is a specific question or problem that is posed, followed by a procedure that generates data and forwarded to the scientific community when a logical solution that is derived that "best" fits the data. These answers using the specifically defined science words are what the students will face on standardized tests in the U.S.

Time Frame/Sequence Reference

"How many children you?"
"Five," replied the woman on James Island,
surrounded by children on the porch and
others in the yard.
"Come on, you've got more than that."
"Oh, you mean *in all*." (Pollitzer, 1999, p. 130)

This quote by a local Sea Island woman identifies the existential concept of living completely in the present moment. Her focus was on the number of children on the porch with her when she was asked the question rather than her total number of children. This "nowness" is an integral part of Island language that we encounter regularly in the public schools. Often the students' use of the island dialect allows their non-dialect speaking teachers to believe that the students are not "very bright" because they don't know the "right" answers or seem to making up numbers for no known reason at all. Such misunderstanding as well as miscommunication often leads to an atmosphere of distrust between the teachers and the students.

In Island Language, the students generally do not use time frame verbs such as is, was, are, and were. This echoes the standard use of Ebonics across the United States (Thompson, 1998). The importance of this pattern of non-verb usage indicates that order or first, next, last does not occur in their language or standard patterns of describing an event. Verbal acknowledgement of past or future doesn't exist; something either is or is not. Verb tense didn't seem to make any difference to our students except on occasion to signify when something was complete. This ties in with the work of DeBose and Faraclas (1993) who state, "verb tense only makes a fundamental distinction between completive and non completive aspects of a predicate" (cited in vanKeulen, Weddington & DuBose, 1993, p.53-54). "In African and Creole languages ...the classification of events is primarily on the basis of whether or not the action or statement is completed" (vanKeulen, Weddington & Dubose, p. 53).

When we worked to help the students code switch, the students began by inserting the verbs which resulted in improper use of language in both the Island way and in Standard form. Examples of the confusion about time frame can be seen in the statement, "When she came out side, we got in and take off." Notice the lack of the verb agreement: two verbs are past tense and the final one is present. Another excerpt also shows confusion of verb usage: "We was play a game." --note the use of two verbs where one would be sufficient. Using two time frame verbs together often occurred in student's journal entries: "Today we wrote our story on the computer is was hard." It appears that some of the confusion over verb tense may relate to the fact that traditional Gullah like standard linguistic Ebonics is spoken in the present tense. During a short dialog prior to the Tangram activity that we will talk about in the next section the following interactions were noted:

S1 "That was I about to do."
S2 "You be runnin too hot for me now."
S1 "My dog die yesterday"
S2 "Mine be different from yours."
S3 "I ain't have no saddest time or no favorite time cause I ain't be there."
"What you mean, put 'em on here and draw what it look like?"
and "He gone get 'em when bells ringin."
S1 "All right I done."

As can readily be seen from this excerpt, the students common way of expressing themselves is in the present tense, even when an event, such as the dog's death, has already happened. Our initial interjection of traditional past tense verb forms ("ed", had, was, were, have) in code switching only served to confuse our students who understood past tense only through the use of the word "**been**". If you wanted them to conjure up a mental image of something that had already taken place, you would need to be talking about "i been happen", meaning that it has already occurred.

"I ain't have no saddest time or no favorite time cause I ain't be there," by S3 is an indication that this student doesn't have a clue that we are really talking about something that has already happened. Of course he doesn't have any saddest time or any favorite time in the immediate present because he is working there with us and class has just started. In order to have engaged the students to think about something in the past, we would have needed to say, "Think about something been sad or something been happy." Because we didn't know enough to do this, we were unable to make what we were talking about relevant to our students and their frame of reference. Relevance or engagement in a science lesson often is drawn from prior experience. Our use of traditional English in combination with their Island language was failing to let our students know that we wanted them to think about the past.

Part vs. Whole

Again verb usage plays an important part in understanding the way of seeing the whole thing as being there or not being there. If it "is," it is one conglomerate or the whole thing. For example, I have two dollar in my pocket means I have 2 dollars in my pocket not necessarily 2 one dollar bills. It is also talking about the whole thing, not talking about the parts and what it takes to make the whole, but rather how the whole thing works in toto. This is also inferring the amount of money the person has for the "cause" currently being discussed and may only be a close estimate. It may also be code meaning the person is willing to put forth more effort/money to this cause.

The students on the island use the Ebonic standard of never making the object plural. For example, they ate one M&M, they ate two M&M, they ate three M&M. Generally, they are looking at the whole picture of M&Ms rather than each piece individually. This quality became very important in terms of one to one mathematical correspondence and the fact that the students were unable to count out the exact number of toothpicks needed for a specific project of building a model house. They were able to grab, basically, the right amount needed because they intuitively (spatially) visualized the completed project as a holistic picture without counting. This ability makes the necessity of counting minimal in their life context. It then became our job to convince them that counting was a significant factor in not getting cheated at the store and in other life situations.

We began that lesson about building a house and what kind of structure would be strongest only to discover that they couldn't count. Needless to say, we were astounded that high school seniors could not do one-to-one mathematical correspondence.

The following is an excerpt from this activity between a teacher and a student:

S1 "I whopped this one. The goof-lookin thing."
T1: "How many pieces?"
S1. "24."
T1. "Count them."
S1. "1,2,3,4,5, ahh geez (realizing his answer is wrong)."
T1. Tells S1 to do another shape and figure out how many units fit into the shape.
S1. "On no. What do I look like? Einstein?"
All right. I gonna use my head this time."(He quickly figures out that 2 of the unit sized shapes fit into one of the larger pieces.)

In another activity where one-to-one correspondence is a requirement, related to pulse rate and what a normal range is, the students were able to find their pulse count it and compare their results with the normal range. The following is a brief interchange between a second teacher a

student.

T Find your pulse
S1 Everyone got a pulse (to another student who cannot find his pulse).
S1 My pump, fast man.
T How do you know your pulse rate is fast?
S1 I looked at what normal and mine faster.

This student had been placed in the lowest level, least challenging of math courses because he did not write out all the steps to each problem the way the teacher wanted. His ability to "look at" the chart and keep his numbers in his head were not valued by that teacher.

Implicit Inference vs. Explicit Description.

_____For all the students, description through language was a very complex issue. Often they omitted words or did not know the specific content words to complete a description. While their indigenous language patterns created holistic pictures of what we were doing, it did not use the exact or precise word to communicate the appropriate meaning to those unfamiliar with their language.

_____In some of the initial verbal interactions and writings of each of the students, there is a paucity of details. A notable example is the habitual response of "Mmmm" to questions, statements and exclamations. This finding relates to the observation that Gullah as it is spoken on Johns Island is a highly inferential language where most of the details and some of the words are left out. However, as an Island speaker you would get the big picture (the whole) or be denigrated for not being smart enough to get the implicit meaning(s). During some of our earlier meetings with the students, we asked them to tell us stories that would enable us to understand their language tradition. In one session, we initiated their language use with the following prompt:

T1. "Tell me a story about matches--of starting a fire."
S4 " i go inne the hou and gette the match. i go uppee (more traditional form would be up nee) the hou. i lightee the match. My grand daddy haul me out and whoop my ass."

Explanation:
This is a story that takes place in the fall. It includes gathering leaves under a house and setting fire to them. These actions created smoke, and the boy's grandfather hauled him from under the house and whooped his ass. Our island students understood the first version of the story completely and were laughing hysterically at it. We didn't get it at all until the students translated it for us (Blake & Van Sickle, 2000).

Some other examples of typical phrases the students used were, "E gon whap ya up da head." and "E gonna baux ya butte." (I'm going to hit you on the side of your head, and I'm gonna kick your butt.) "Yous teevin." "Yous teef." (You're stealing, theif), "Cum jine we." (Come, join us.)

Contributions of the Three Components to a World View

These three components of time frame reference, part vs. whole, and implicite inference vs. explicit description operate in unison to help form a world view for the students. Any teacher who understands this unique world view can utilize the component(s) to his or her advantage to conduct an exciting, relevant activity that teaches a concept. Any teacher who does not have this understanding won't have a clue as to how to reach these students.

Learning about physics through making tops:

Dr. B. What's special about the ones that spun the longest?
S1: Low and heavy
Dr. B.: What about the pencil (axle)?
S2: Axle?
Dr. B. : Yes, but where is it in the plate?
S3: In the center.
Dr. B. (Draws a circle on the board with a radius indicated. Points to the radius.)

	What do we call this?
S4:	The radius.
Dr. B.:	What else?
S1:	Weight.
Dr. B.:	What's that called?
S5:	Symmetry.
Dr. B.:	Did we figure out some of the problems?
S3:	Center too high.

Oakes (1990) notes that traditionally African-American students aren't involved in Science/math classes, are in lower level classes, or that science and mathematics where significant content is not offered. These students were describing balance, symmetry, center of gravity, energy input, etc. into the system called a top. They completed tops and learned the science/math language that was necessary for the SCEE they would be taking.

Jegede and Aikenhead (1998) have compiled information that indicates that African-American students are operating from a much different world view than the traditional western linear world view. This work with the tops indicates the same holistic world view from which our students began. They understood, "top be balance."

(put fig. 1 about here)

We had to understand all the parts of their word "balance" and then code-switch their descriptions to the vocabulary needed for standardized testing. As the teachers fail to understand the holistic view the students know, their Island language works against the students and causes them to be placed in lower track courses in science and mathematics. Their language also limits their ability to pass the tests, and they need to pass the tests to get into science and math classes, get out of high school, and get into two and four year college programs and eventually higher paying jobs.

Facilitating Crossings between World Views

Students can develop, use, and adopt more than one world view given the right circumstances. Ethnicity isn't destiny. In order to enlarge or increase each student's ability to cross cultural borders and to code switch between different dialects of a language, it is important to demonstrate respect for both views. For example, while western science has provided us with a multitude of benefits, the Gullah culture of our students has provided our area with the profits of rice, indigo, cotton, jazz and blues music, an understanding of medicinal herbs, and a method of making sea grass baskets that exists only in the Lowcountry and the western part of Africa.

Code switching between the dialects of school and home is an activity that all the students proved capable of. In many instances, students were able to understand the science or math concept being presented through the inquiry activity and accurately describe the learning through the use of Island language. For example, in the previously reported physics activity involving tops, one student said, "Top be balance." He was indicating that the essence of the object was to be balanced. His statement was absolutely correct, but it was looking at the whole of what made the top work. In this case the Western, modern view of how a top works would be to look at the parts or variables: the distribution of mass, the symmetry of the length from the axle, and the center of gravity or how high the top should be on the axle, etc.

Code switching about the tops began with an initial drawing where the student wrote his description. Recognizing his accurate comprehension of the essence of a top, one of the researchers provided the detailed variable words of axle, symmetry, mass, height, radius, and balance. The student immediately began incorporating these words into his next drawing pictured in Figure 2.

By the time he was through, he not only had the basic understanding of the whole, he also had the language to communicate about the the parts and pieces (variables of the whole) to those who hold a Western view of science. In addition, he and the other students involved were able to apply all of these understandings (whole and part) to their daily lives in dealing with automobile maintenance and the balancing of tires.

In the writing of stories, initial efforts tended to illustrate the inferential nature of the Island

language through the absence of details (the parts and pieces that would be variables and attributes in science). Through the use of writing workshop and continued interaction through questioning for details and sequence, a picture emerges that would be comprehensible by both island speakers and those communicating in a standard Western dialect.

Teacher Education Implications

Our experiences with these students have shown how important it is for teacher education programs to acknowledge differences in language/culture and world view. Those same programs then need to promote the types of teaching/learning strategies that don't discount an indigenous world view while encouraging alternative ways of viewing the world and communicating about it. According to linguist McWhorter (2000) "Colloquial dialects are as complex and nuanced as standard ones" (p. 10). Our intent was to learn some of the complexities and nuances the students in this local area were using so that we could learn to teach them and then use the cases to teach our present and future teachers. We are very aware of need of "professors" for credibility in the field with "our" students. We feel the time and effort spent researching this topic to date has yielded cases that our teachers understand and our credibility has increased because we "survived".

We also valued our students' Island language; we never tried to get them to stop using it. What we did try to do was to help them acquire some specific terminology, sequencing skills, and alternative grammar structures to use in language, math, and science situations where they had acquired knowledge through inquiry. All teachers need to know how to do this. As McWhorter (2000) so eloquently stated,

> This is in no way a call for students to simply be allowed to speak only colloquial English. Always and forever, the standard variety will be indispensable to upward mobility, and always and forever, one of the main places children acquire comfort and fluency in the standard variety will be in school (p. 15).

We agree, and we hope that our teachers will become sensitive to the issue, become engrossed with their students, code-switch with them until they are able to do it for themselves and thus increase our students ability to compete in cases where a standard form of English is used.

Wang, Haertel and Walberg (1993) completed a large meta-anaylsis of school reform and the educational needs of at-risk students. They describe their findings focusing on three categories 1) developing new attitudes, 2) implementing curriculum innovations and 3) using new and varied instructional strategies. We tend to agree. As educators it is very important for us to learn about interdependent and intradependent cultural psychology (Greenfield & Cocking, 1994). Such information on cultural psychology helps us understand some of the knowledge children bring to school with them and the cultural values which dictate how they are taught at home. Such knowledge can help teachers build on strengths rather than focus on remediation and distinguish between cultural differences and deficits.

When thinking within the framework of cultural psychology, the issue of using real life/relevant and complex issues as in problem based learning helps focus the teaching and learning for the students. In all the cases in our study we gave students complex problems to solve and embedded the basic skills within the lesson. We thus used the knowledge and understanding they had, but did not revisit a basic kindergarten skill using kindergarten lessons. For example, when we discovered they couldn't count, we had them build houses to figure out the relative strengths of building structure shapes. They had to "buy" the exact number of building materials from us and pay for them. We built on their cultural spatial skill of knowing how much material they needed by sight, not by measurement or counting. Thus, we were able to teach geometry skills and one-to-one correspondence in a single lesson. We did not feel it was fair to insult their intelligence nor to challenge who or what had been taught or learned in their previous years of schooling. Although the smoke did roll out of our ears when we discovered the deficit (we did not let them know).

Finally, we found it extremely helpful to use problem-based learning and as high a level of inquiry type of lesson as possible with our students. This required that we model our own thinking strategies and build from one concept to the next or scaffold. We used these teaching tactics

consistently because they require a higher level of dialog which helps increase vocabulary development (Blake & Van Sickle, 2000). These strategies are also more like the holistic thinking students are taught at home, especially when required to look at all issues simultaneously and develop a solution. These methods also address Tobias' concerns in her book They're not dumb they're different, when she refers to students who are bored with the singular cause and effect problems specifically because they are not real life and do not study the multitude of variables that are occurring.

It is our hope that these explanations will provide some new lenses for others as they view students who are not "achieving" in their geographic areas. Our experience informed us about the need to constantly diagnose through dialogue what students were already capable of and which components were missing that was causing the mismatch between what they actually knew versus what they were scoring on standardized tests. It then became our job to use every creative fiber we had to develop lessons that were engaging, full of dialogue and used the students' strengths while simultaneously filling in some gapping holes in their knowledge base. Actually, this challenge brought us the most excitement and joy in teaching. It allowed us to show our professionalism, creativity and experience the moments of pure learning that the brain so graciously grants us.

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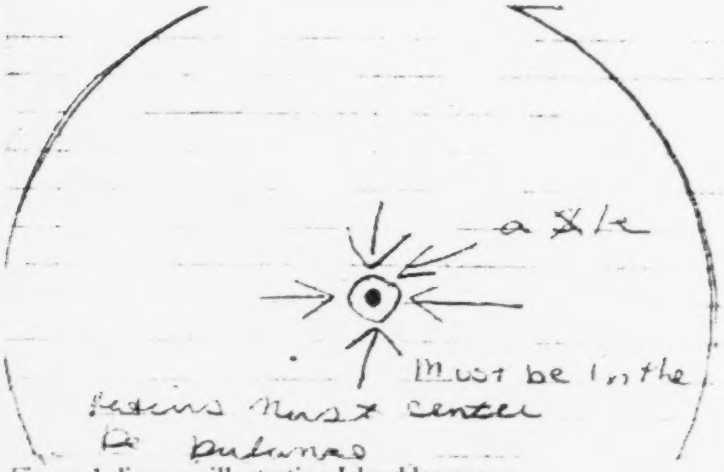

Figure 1 diagram illustrating Island language

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